many of the families of moths and the subfamilies of Noctuidæ still to be monographed are undoubtedly much less numerous in species than those already described.

When we consider how very few species of insects were known to entomologists a century, or half, or even a quarter of a century ago, the enormous increase in our knowledge of this subject within the last few years is simply marvellous, even to those who have witnessed, and to some extent kept touch with, its progress from day to day.

Report on the Poultry Industry in Belgium. By Edward Brown. Pp. viii+112. (London: National Poultry Organization Society, Ltd., 1910.) Price 1s. net.

IN 1906 and 1907 Mr. Brown visited America, Denmark, and Sweden to inquire into the methods followed in the poultry industry, and during last year he visited Belgium with a similar object. Probably in no country in the world is intense production more general than in Belgium, one consequence being that it supplies its own poultry and egg requirements, and is not dependent, like England, on imports from foreign countries; indeed, it has a surplus for export.

Although in some respects the conditions in Belgium resemble those obtaining in England, there is the fundamental difference that the Belgian farmer specialises in small animals, like poultry, rabbits, even in pigeons and cage-birds as a hobby, whilst the English farmer has gone in for larger stock. Poultry-farming pure and simple is not common. But everywhere Mr. Brown found that poultry figured as an adjunct to the farm, particularly on the small holdings. In some cases, indeed, land did not come under cultivation until it had been run over for some years by fowls, and fertilised by their droppings. Thus the Campine district, which extends from Malines east and north to the Dutch frontier, was at one time merely a sandy plain covered with fir trees. About thirty years ago the peasants began to raise chickens for sale to the fatteners; the industry spread, and now the trees are gone and the whole district is farmed. It would be interesting to know how many tons of purchased food were consumed per acre in effecting this change. Egg-production is stated to be the main object, and the birds are looked after by the women and children; the methods are, however, essentially simple, no more elaborate appliance being used than is absolutely essential.

The report contains a number of useful details, and concludes with a number of recommendations. The small holder in particular is urged to devote some, though not all, of his attention to poultry, and it is suggested that poultry-keeping should be encouraged on land at present waste. Various methods of management are also recommended.

Halley's Comet: its History, with that of other noted Comets, and other Astronomical Phenomena, Superstitions, &c. By Rev. John Brown. Pp. 52; illustrated. (London: Elliot Stock, 1910.) Price 1s. net.

As a useful collection of facts and references concerning Halley's comet this small volume will take a place in the mass of comet literature now appearing so profusely. It contains nothing startlingly novel, being, to a great extent, a compilation of interesting oddments gathered, with due acknowledgments, from various sources. In many places extraneous material is introduced, rendering the book perhaps more interesting, but less suitable as a precise account of what it presumes to deal with. The four illustrations are rather crude and of no especial interest.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Orientation of Crystals of Ice in a Flux of Heat.

IT was found by Forbes many years ago that the thermal conductivity of ice was better along the principal axis than at right angles to it. Straneo, in 1897, does not come to any definite conclusion in deciding that such is the case. It is well known, however, that the formation of surface ice by conduction always shows the principal axis of the crystals to be normal to the freezing plane, or, in other words, in the direction of the flux of heat from the underwater. Since ice is a better conductor of heat than water, it is to be expected that if any difference exists in the conductivity in the two directions, the ice crystal would form in such a way as to dissipate the heat more readily.

During the process of the formation of an ice mantle in a rather large Bunsen ice calorimeter, my assistant, Mr. F. H. Day, directed my attention to a rather interesting case, which, I think, proves the better conduction along the axis of the crystal. The bulb of the calorimeter was about two-thirds immersed in a freezing-point mixture. This particular calorimeter was unusually difficult to start, and always refused to freeze when ether was rapidly evaporated in it, or when a saline ice mixture was introduced. In consequence, our custom has been to add some liquid air or solid carbon dioxide, as most convenient at the time. In this case we used solid carbon dioxide. The undercooling must have been considerable around the inner glass tube, and a sharp temperature gradient resulted between the lower part of the glass and the walls of the calorimeter. Heat was flowing in from the freezing-point mixture, but near the surface the heat flowed in more rapidly around the exposed portion of the bulb. The ice formed as usual, but on withdrawing the calorimeter for inspection we found, growing out from the solid mantle of ice, long needles and thin plates, which were perfectly orientated along the lines of the flow of heat. The crystals near the top of the mantle were directed at an angle upwards, while those at the base were found normal to the mantle surface. Between these positions the crystals grew at a corresponding inclination to the mantle surface. This, I think, conclusively shows the path of best conductivity in the ice crystal to be along the principal axis.

H. T. BARNES.

McGill University, April 19.

Zeeman Effect of the Yellow Mercury Line λ 5770.

IT is well known that the separation of the mercury line λ 5770 in a magnetic field into a triplet is abnormal, inasmuch as the value of the ratio e/m of vibrating electrons is much greater than that obtained from experiments on kathode rays or from measurements of the Zeeman effect on other lines of mercury and of other elements. Lohmann first noticed that the line is separated into a nonet in strong fields, but did not investigate its type. By using an echelon spectroscope of resolving power 430,000 for $\lambda = 0{\cdot}5\mu$, I found that the distribution of lines in the nonet can be accurately examined by using a vacuum tube of special construction. From a field of 18,000 gauss upward, the lines composing the nonet were distinctly observed with my instrument. They are distributed in three groups of three lines each, closely arranged at equal intervals, and each group occupies the position of the normal triplet. No dissymmetry with respect to the middle line was noticed. Several measurements in fields between 18,000 and 28,000 showed that the separation of lines in each group is proportional to the field strength, so that in weak fields each group appears as a single line. The lines of the middle group are equally bright, but the intensity of the remaining two groups of lines diminishes as we proceed outwards, just as is the case with the mercury line 5461, which is also divided into

a nonet. Runge's law is applicable to 5770; the type of the nonet is such that the lines form aliquot parts of $a=e/m.\mathrm{H}/4\pi$, and the difference in the number of vibrations of these lines can be represented by

$$0, \pm\frac{a}{8}, \pm\frac{8}{8}a, \pm\frac{9}{8}a, \pm\frac{10}{8}a.$$

Considered as a triplet, which corresponds to lines 0, $\pm\frac{9}{8}a$, Gmelin found that $e/m=2{\cdot}02\times10^7$; v. Baeyer and Gehrcke obtained $2{\cdot}06\times10^7$, which is also the number I have arrived at from the same standpoint. Considered as a nonet, however, we have to multiply the above number by $\frac{8}{9}$, so that the corrected result turns out to be:—

Gmelin	$1{\cdot}80\times10^7$
Gehrcke and v. Baeyer	$1{\cdot}83\times10^7$
Nagaoka	$1{\cdot}83\times10^7$

This is in close agreement with the same constant obtained from measurements on the nonet of the mercury line 5461, for which $e/m=1{\cdot}80\times10^7$.

The above examination of the line 5770 shows how the different types of a class of nonets are derived from normal triplets.

Starting from the normal triplet A, we get nonets of types B, C, and D by doubling the intervals of component

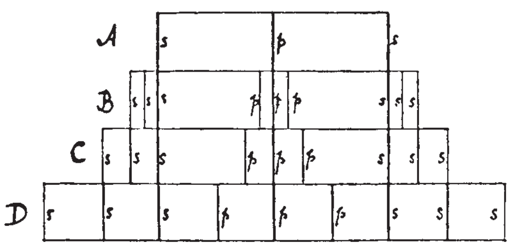

FIG. 1.

lines of each group, as shown in Fig. 1. Considered as aliquot parts of a, they are represented by

$$\text{B.}\quad 0, \pm\frac{a}{8}, \pm\frac{8}{8}a, \pm\frac{9}{8}a, \pm\frac{10}{8}a.$$

$$\text{C.}\quad 0, \pm\frac{a}{4}, \pm\frac{4}{4}a, \pm\frac{5}{4}a, \pm\frac{6}{4}a.$$

$$\text{D.}\quad 0, \pm\frac{a}{2}, \pm\frac{2}{2}a, \pm\frac{3}{2}a, \pm\frac{4}{2}a,$$

with direction of electric force as shown in the figure, p indicating that it is parallel, and s at right angles, to the direction of the field. B is represented by the line 5770, C by the neon lines 6678 and 6305, and D by the mercury line 5461. Probably there is also a type

$$0, \pm\frac{a}{16}, \pm\frac{16}{16}a, \pm\frac{17}{16}a, \pm\frac{18}{16}a,$$

intermediate between A and B. Of the different lines which I have examined, the copper line 5105 seems to belong to this type, but as it requires high resolving power I have not been able to clear up this point. It appears to me quite probable that triplets, which show broadening of lines and no asymmetry in high fields, and give values of e/m greater than $1{\cdot}87\times10^7$, belong to some of the intermediate types.

H. NAGAOKA.

Physical Institute, University of Tokyo, March 29.

The Fertilising Influence of Sunlight.

IN NATURE of February 17 is a communication from Mr. and Mrs. Howard pointing out that the probable explanation of the advantage of leaving land rough ploughed during the hot weather in India is that the biological changes which occurred under the conditions of Messrs. Russell and Hutchinson's experiments occur here also.

The following temperature record, which is one of the highest I have, will be of interest in this relation:—

Date, May 28, 1906.

Maximum shade temperature	107° F.	... 42° C.
Maximum temperature of soil 3 in. deep	109	... 43
,, ,, ,, 6 ,,	109	... 43
,, ,, ,, 9 ,,	104	... 40
,, ,, ,, 12 ,,	100	... 38
,, ,, ,, 24 ,,	93	... 34

Other records of soil temperature in Behar are published in "An Account of the Research Work in Indigo at Dalsing Serai, 1903-4," by Bloxam, Leake and Finlow (Appendix ii.). Temperatures approximating to 50° C. at 1 inch from the surface were recorded.

The hot-weather temperature here (Behar) is not so high as in some other parts. Jacobabad "enjoys" one which runs up to 127° F. on occasions, and the whole of the western part of the Punjab (an area equal to about twice that of the British Isles) is liable to maximum air temperatures of 110°–115° F. (43°–46° C.), so that the surface soil in that part may be assumed to attain an average temperature some 10° F. (5° C.) higher than here at Pusa; but it is certain that, however uncomfortably hot India is, its soils never attain a temperature anything approaching 100° C.

Dr. Russell mentions (NATURE, March 3) that biological changes at temperatures below 100° C. are being studied, so that we shall doubtless learn shortly in how far they assimilate under these conditions to the effect at 100° C. In any case, it must not be forgotten that there cannot be much difference in temperature between roughly ploughed land and unploughed land which has carried a cold-weather crop; in both the amount of moisture in the first 6 inches will be nominal, and the thermal capacity of each must be much about the same. The roughly ploughed soil will include more air, and I should expect the rise of temperature at 6 inches to be rather greater in unploughed land. Hence if this agricultural practice is found to be accompanied by important biological changes, this must be due to some cause other than mere temperature.

Regarding the effect of *sunlight*, this can only affect the outside surface; in unploughed land this is better defined than in broken-up land, and during the ploughing operation more soil is exposed (temporarily) to the sun than in the former case, but the ploughing here referred to is commonly *one* ploughing, not a "multiple stirring" such as occurs in the preparation of the seed bed.

Finally, it is perhaps unnecessary to mention that this rough ploughing results in other advantages than those mentioned. One is that the soil absorbs more of the first monsoon rain than unploughed land, and can be prepared for monsoon crops much more quickly.

Pusa, April 13. J. WALTER LEATHER.

Observations of Halley's Comet.

I SAW Halley's comet through field-glasses on Sunday morning, April 24, at 3.40. It was then about 10° above the horizon, 20° to the left of Venus, and slightly under it. It was very distinct from 4.0 to 4.20. At its best, 4.15, I could just distinguish the head by the naked eye, but only for a minute.

The tail appeared broad and short, only about twice the moon's apparent diameter in length, with its axis at 40° to the horizon. The tail began to grow indistinct at 4.30, but the head was visible to 4.45.

The sky was not ideal, Pegasus not distinct, Cassiopeia only partially seen, but Venus was very distinct and bright.

I saw the comet again yesterday—Monday, April 25—from 4.0 to 4.15. The sky was not at all clear. The comet was in a line with Venus, and still about 20° to the left. I could not see it with the naked eye.

This morning, April 26, comet was clearly seen from 3.45 to 4.30. The tail appeared longer and more elegant in appearance. It was perhaps 5° above Venus, and less than 20° to the left. The head was easily seen at intervals by the naked eye, but the tail showed only a trace, and that only once.

The measurements are only by the eye, but are, I think, fairly correct. C. LEACH.

Malta, April 26.